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Turkish adaptation of the post-intensive care syndrome questionnaire: A validity and reliability study

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Abstract
Aim: In this study, we aimed to adapt and determine the psychometric properties of the Turkish version of the Post-Intensive Care Syndrome Questionnaire.
Material and Methods: This methodological study was conducted with 120 patients discharged from different intensive care units in Turkey between May 2020 and June 2021. Data were collected using a Socio-Demographic Form, Post-Intensive Care Syndrome Questionnaire, the General Health Poll, and the Pittsburgh Sleep Quality Index. Language and content validity were studied to adapt the scale. The construct validity was analyzed using confirmatory factor analysis. Reliability was evaluated with Cronbach's alpha coefficient, item-total score correlation, and similar measurement tools.
Results: As a result of confirmatory factor analysis, the 10-item and 3-factor structure of the scale was determined. The factor loads of the items were between 0.60 and 0.90. Cronbach's alpha was determined as 0.94. There was a strong positive correlation between scales.
Discussion: The Turkish version of the Post-Intensive Care Syndrome Questionnaire is a valid and reliable instrument for the Turkish population.

Keywords
Intensive Care, Psychometrics, Reliability, Validity

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Introduction

Intensive care units (ICU) reduce mortality rates by increasing the chance of survival of patients with technological developments and advances in medicine [1]. This especially contributes to the controlled recovery of patients suffering from uncontrolled infections and sepsis, catabolic state, major surgical interventions, traumas, multiple organ failures, SIRS, and prolonged mechanical ventilation [2]. Therefore, it often provides a sense of security and control for patients and their families. Although ICU has an important place in the survival of patients, it has been determined that patients who experience intensive care have memory, attention, emotion and insomnia problems [3-5]. These problems have been termed "post-intensive care syndrome" (PICS) by the Society of Critical Care Medicine [6]. PICS is a cognitive, physical, and mental disorder that occurs during ICU stay or after discharge from an ICU and involves the long-term prognosis of ICU patients and its effects on the patient's family [7]. These problems create serious obstacles both to discharge from the hospital to the home environment and to adapting to daily life after returning home [3].

Prolonged stay of patients in the ICU causes an increased risk of long-term physical, cognitive and mental complications. Risk factors for PICS include advanced age, delirium, acute brain dysfunction, hypoxia, hypotension, glucose dysregulation, sepsis, sedation, mechanical ventilation, and premorbid mental and physical comorbidity [8,9].

Post-ICU patients may suffer from physical problems like weakness, dysphagia, wasting syndrome, dyspnea, pain, sexual dysfunction, etc., as well as mental health problems like depression, anxiety, panic disorder, or posttraumatic stress disorder (PTSD) [4,8]. Torres et al. [9] identified depression, anxiety, PTSD, weakness, and movement disorder in patients with intensive care experience. In the study of Chung et al. [10], it was stated that the patients who remained on mechanical ventilation for a long time in the ICU experienced nightmares, panic disorder, anxiety, difficulty in breathing and the feeling/fear of suffocation. In addition, Colbenson et al. [1] reported that most of the patients staying in the ICU experienced cognitive problems for a long period of their lives. They stated that the physical effects of the intensive care experience also impair the patient's quality of life and as a result, they may have difficulty in continuing their daily lives. They also reported that frequent re-admission to the ICU may lead to trauma in patients and their families.

Many assessment tools are used to evaluate the cognitive, physical, and mental difficulties experienced by patients with intensive care experience in Turkey [11-13]. However, there is no scale where these difficulties of patients were evaluated with a single scale. Therefore, the aim of this study is to evaluate the psychometric analysis of the Post-Intensive Care Syndrome Questionnaire.

Material and Methods

Participants and Setting

This study was conducted between May 2020 and June 2021 with 120 patients (considering the number of scale items for the 18-item scale) in the ICU of an education and research hospital in Turkey. The literature recommends that the sample size should be 5-10 people for each scale item in validity and reliability studies [14,15]. The criteria for inclusion were age over 18 years, experience of staying in the ICU for at least 2 nights, at least 1 month and not more than 1 year after leaving the ICU, and voluntary participation in the study. The list of patients discharged from the ICU was accessed through the hospital's automation system. Data were collected via telephone. Before the study began, patients were contacted by phone to inform them about the purpose and process of the study.

Instruments

Socio-demographic Form: It was used to collect socio-demographic information of the patients.

Post-Intensive Care Syndrome Questionnaire (PICSQ): It was developed by Jeong and Kang [16]. The 4-point Likert-type (0=Never, 1=Sometimes, 2=Most often, 3=Always) scale consists of 18 items and three sub-dimensions. These are cognitive (1st, 2nd, 3rd, 4th, 5th, 6th items), physical (7th, 8th, 9th, 10th, 11th, 12th items), and mental (13th, 14th, 15th, 16th 17th, 18th items) sub-dimensions. The total score of PICSQ is between 0 and 54, or the mean is between 0 and 3. High scores show that the level of PICS is high. The Cronbach's alpha for the PICSQ was 0.94 and its sub-dimensions were between 0.87 and 0.95 in this study.

General Health Poll (GHP): It was developed by Goldberg [17] and adapted in Turkish by Kılıç [18]. It consists of 20 items on a 4-point Likert-type scale. The minimum and maximum scores of the scale are 0 and 36. High scores indicate that the incidence of mental problems (anxiety and depression) increases. Cronbach's alpha for the GHP was 0.75 for this study.

Pittsburgh Sleep Quality Index (PSQI): It was developed by Buysse et al. [19] and tested for the Turkish language by Ağargün et al. [20] to evaluate the sleep quality in the last month. The index includes 24 questions, nineteen of these are self-report questions and answered by the patient, five questions are answered by a spouse or roommate. These five questions are not included in the scoring and are therefore used for clinical information only. The last of the self-report questions (question 19) is about the availability of a roommate or spouse and is not used in scoring. The total score is between 0-21. A total score higher than five indicates poor sleep quality. In this study, the Cronbach's alpha for the PSQI was 0.69.

Ethical Consideration

Permission was obtained from the corresponding author of the original PICSQ [16] and from the University Ethics Committee. The study was conducted according to the Declaration of Helsinki and consent was obtained from the patients who volunteered to participate in the study.

Statistical Analysis

For the analysis of the data, SPSS 21.0 and AMOS 22.0 statistical programs were used. Number, percentage, mean and standard deviation were calculated for descriptive statistics. Language and content validity were studied during the adaptation process. Confirmatory factor analysis (CFA) was used within the scope of the validity, and item-total correlation, Cronbach's alpha coefficient, and equivalent form analyses were used within the scope of the reliability of the study. CFA evaluates

whether a previously defined and constrained construct has been validated as a model. CFA is one of the structural equation models, and in structural equation models, the model fit must be ensured first. In the evaluation of model fit, "Chi-square statistics to the degree of freedom ratio" (X2/df), "statistical significance of individual parameter estimates" (t value), "standardized root-mean-square residual" (SRMR), "goodness-of-fit index" (GFI), "non-normed fit index" (NNFI), "comparative fit index" (CFI) and "root mean square error of approximation (RMSEA)" were used. Structural Equation Modelling was also applied. Pearson correlation analysis was applied to determine the relationship between the scales. For statistical significance, $p<0.05$ was accepted.

Results

Of the patients, 60.8% (n=73) were females, their mean age was 53.68±13.68 years, 66.7% (n=80) were hospitalized in the surgical ICU, 57.5% (n=69) were admitted electively, and 23.3% (n=28) received mechanical ventilation. The mean length of stay in the ICU was 3.33±2.33 days, and the mean time after discharge was 5.64±3.47 months, and 13.3% (n=16) were re-hospitalised.

Validity

The findings obtained in the CFA performed with the 18 items and 3-sub-dimensional structure of the PICSQ are given in Table 1. According to the results of the CFA, it was determined that the item factor loads were quite high, but the values of the model fit indices were not in the appropriate ranges. When the suggested covariance connections were examined, it was determined that the items had a high correlation with the items in the other factors, despite the high factor loading in the factor they belonged to. This indicates that the scale has a low level of discrimination and, accordingly, the model fit indices cannot reach a sufficient level. On the other hand, it was determined that there was no significant improvement in the fit indices, although the suggested covariance connections were made for the other items in the factor to which the items belonged. For the stated reasons, the items with high correlation with the items in other factors were gradually removed from the scale (primarily with the highest covariance correlation value), and the model fit indices were tried to be improved. After the remaining 10 items and three covariance connections in the scale (item3-item5, item9-item11, item16-item18), it was determined that

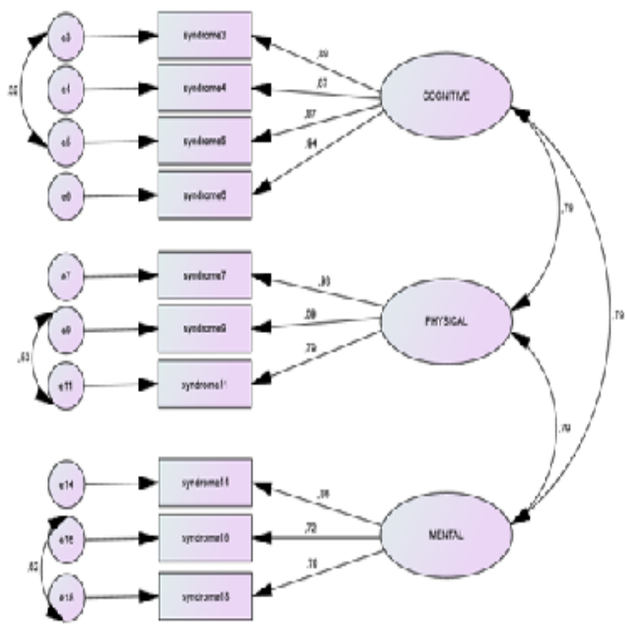

Figure 1. CFA diagram of PICSQ

Table 1. Model fit indices obtained in the confirmatory factor analysis (CFA) of the PICSQ

Model Fit Indices	The first CFA	The last CFA*	Perfect Fit[b]
	18 items	10 items	
	3 sub-dimensions	3 sub-dimensions	
X2/df	4.258	2.196	<3
SRMR	0.093	0.039	<0.05
GFI	0.655	0.906	>0.95
NNFI	0.772	0.950	>0.95
CFI	0.803	0.968	>0.95
RMSEA	0.165	0.100	<0.08
Factor load	0.60 / 0.93	0.69 / 0.93	
Correlation between factors	0.74/0.78/0.86	0.79/0.79/0.79	
Explained total variance [a]	77.85%	84.52%	

Abbreviations: [a] Tested by exploratory factor analysis, [b] Çokluk, Şekercioğlu, and Büyüköztürk, (2010), * With covariance connections

Table 2. CFA Results of PICSQ

Item and Sub-dimension	Std. β	t	F1 λ	F2 λ	F3 λ	r	Cronbach's Alpha (0.94)
Cognitive (%36.23)							
Item 3	0.89		0.87	0.18	0.30	0.78	0.95
Item 4	0.87	13.72*	0.81	0.30	0.24	0.78	
Item 5	0.87	17.04*	0.86	0.16	0.31	0.77	
Item 6	0.94	16.33*	0.86	0.33	0.22	0.82	
Physical (%24.77)							
Item 7	0.93		0.52	0.67	0.26	0.80	0.89
Item 9	0.69	8.44*	0.21	0.90	0.15	0.64	
Item 11	0.79	10.31*	0.22	0.84	0.37	0.74	
Mental (%23.51)							
Item 14	0.86		0.43	0.38	0.60	0.76	0.87
Item 16	0.72	8.08*	0.23	0.19	0.89	0.66	
Item 18	0.79	9.11*	0.33	0.28	0.82	0.74	

Abbreviations: r: Item Total Correlation, *p<0.01

Table 3. Equivalent Form Correlation Results

	A	A1	A2	A3	B	C	X	SD	S.	K.
PICSQ (A)	1	0.67*	0.90*	0.87*	0.38*	0.42*	14.86	5.65	1.83	3.47
Cognitive (A1)		1	0.51*	0.55*	0.27*	0.25*	5.12	2.44	2.67	7.08
Physical (A2)			1	0.66*	0.25*	0.31*	5.32	2.20	0.91	0.32
Mental (A3)				1	0.38*	0.42*	4.41	1.78	1.39	2.12
GHP (B)					1	0.48*	13.21	4.97	0.55	0.96
PSQI (C)						1	11.95	1.71	1.27	2.50

Abbreviations: PICSQ: Post-Intensive Care Syndrome Questionnaire, GHP: General Health Poll, PSQI: Pittsburgh Sleep Quality Index, X: Mean, SD: Standard Deviation, S.: Skewness K.: Kurtosis, *p<0.01

the model fit indices reached good and very good levels, and the factor loads remained within the appropriate ranges (Table 1).

The results of the validity analysis, consisting of factor load and t values, are shown in Table 2. As a result of the CFA, it was determined that the factor loads of the remaining 10 items in the scale were higher than 0.40, and the t values of the items were significant ($p<0.01$). It was also determined that the total scale had 84.52% of the total variance. According to the results obtained, it was determined that the PICSQ is a valid scale with 10 items and 3 sub-dimensional structures. The verified model's CFA diagram is shown in Figure 1.

Reliability

Cronbach's alpha was evaluated to determine the internal consistency of the scale. Cronbach's alpha was 0.94 for the scale, and it was between 0.87 and 0.95 for sub-dimensions. It was determined that the item-total correlation for all items ranged from 0.64 to 0.82 (Table 2).

The minimum and maximum scores of the PICSQ are 0 and 30, and the mean score was determined as 14.86±5.65. The minimum and maximum scores of the cognitive, physical, and mental sub-dimensions of the PICSQ are 0-12, 0-9, and 0-9, respectively. The mean scores of the cognitive, physical, and mental sub-dimensions of the PICSQ were 5.12±2.44, 5.32±2.20, and 4.41±1.78, respectively. The minimum and maximum scores of the GHP are 0 and 36, and the mean score was 13.21±4.97. The minimum and maximum scores of the PSQI are 0 and 21, and the mean score was 11.95±1.71 (Table 3).

For the scale's equivalent form reliability analysis, the correlation results between PICSQ, GHP, and PSQI are given in Table 3. Correlation values of the relationship between PICSQ total scores and GHP were determined as 0.38; correlation values of the relationships between the sub-dimensions of PICSQ and GHP were determined between 0.27 and 0.38 ($p<0.01$). When the correlations between PICSQ and PSQI were examined, the correlation between the total scores was 0.42, and the correlations of the sub-dimensions were between 0.25 and 0.42 ($p<0.01$). These correlation results show the consistency of the PICSQ.

Discussion

The Turkish validity and reliability of the PICSQ were evaluated in this study since there is no comprehensive tool that can be used in Turkey to evaluate the PICS in patients with intensive care experience. This study was conducted with 120 patients. The literature recommends that the sample size should not be less than 5-10 times the number of scale items in order to perform factor analysis in scale studies [14,15]. For this reason, at least 5 participant rules were provided for each item of the 18 items used in the assessment.

Validity

In this study, the construct validity of the PICSQ was determined by factor loads, and it was determined that although the factor loads were quite high, the values of the model fit indices were not in the appropriate ranges. For this reason, the proposed covariance connections were examined and 8 items (1, 2, 8, 10, 12, 13, 15, 17) that had a high correlation with the items in the other factors, despite the high factor load in the factor they belonged to, were gradually removed from the scale. As a result of CFA, the model fit indexes of the remaining 10 items in the scale were determined as x2/df=0.196; SRMR=0.039; GFI=0.906; NFI=0.950; CFI=0.968; and RMSEA=0.100 (Table 1). The results of this study meet the perfect fit criteria specified in the model fit index results in the literature [21,22]. In the study, it was determined that the scale covered 84.52% of the total variance. In addition, in this study, the factor loads of the items were between 0.60 and 0.90, and a 3 sub-dimensional structure was determined (Table 2). This result meets the recommendation in the literature that factor loads should be greater than 0.40 and explain at least 30% of the variance [14]. In addition, it was determined that the 3 sub-dimensional structure of the scale was similar to the original scale [16].

Reliability

Cronbach's alpha coefficient used to evaluate the internal consistency of this scale was calculated as 0.94 (Table 2). In scale validity and reliability studies, it is recommended to calculate Cronbach's alpha coefficient to determine the reliability of the Likert-type scale [23]. Cronbach's alpha coefficient of the original scale was reported as 0.93 [16]. It is stated that the scale is not reliable if Cronbach's alpha is $0.00<\alpha<0.40$, it is low reliable if $0.40<\alpha<0.60$, it is reliable if $0.60<\alpha<0.80$, and it is quite reliable if $0.80<\alpha<1.00$ [14]. Since the Cronbach alpha value was determined to be higher than 0.70 in the Turkish version of the PICSQ, it can be said that the scale is a very reliable instrument.

Another test used to assess internal consistency is item-total score correlation. It is stated that the total score correlation of an item should be at least 0.30 statistically [24]. In this study, each of the item-total correlations of the scale was determined above the recommended minimum level (0.64-0.82). Therefore, it can be said that the internal consistency of the scale and all its items is high (Table 2).

It is recommended to either re-test the scale or use equivalent tests to determine the invariance of the scale over time [14,24]. In this study, a re-test was not performed because of the PICS instability in the patients after discharge from the ICU. This problem was solved using similar scales. In this study, GHP and PSQI were used as equivalent tests to determine the invariance of the scale over time. In the correlation analyses performed between the scales, the correlation values between PICSQ total and GHP and PSQI were found to be 0.38 and 0.42 and statistically significant ($p<0.01$) (Table 3). When correlation values are evaluated as 0-0.2=very weak, 0.2-0.4=weak, 0.4-0.6=moderate, 0.6-0.8=strong, and 0.8-1.0=very strong [23], it can be said that there is a strong and significant positive correlation between the scales.

Limitations

This study was conducted via telephone, but not face-to-face. Therefore, a formal environment could not be created. This study was conducted with patients discharged from different ICUs of a single hospital. In addition, other cognitive, physical, and mental factors affecting patients could not be controlled.

Conclusions

When the validity and reliability analyses were evaluated together, it was determined that the Turkish version of the

PICSQ was a reliable and valid scale with 10 items and a 3-dimensional structure. PICSQ can be accepted as a valid and reliable tool to evaluate PICS in adults with intensive care experience in Turkey. It can be recommended to apply the scale to different and wider populations in Turkey.

Scientific Responsibility Statement
The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement
All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest
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